Claim 1] The hand spindle supported free [rotation] while inserting the end in the plotting board, and the indicator fixed to the end of the above-mentioned hand spindle, It has the move lateral-electrode board fixed to the other end of the above-mentioned hand spindle, and the fixed side electrode board which has arranged two or more electrodes which countered this move lateral-electrode board and were fixed to the above-mentioned plotting board side. Display equipped with the electrostatic actuator which carries out the rotation drive of the move lateral-electrode board towards desired to a fixed side electrode board by the suction force which changes polarity to the electrode of this fixed side electrode board, impresses voltage, and is produced between charges, and repulsive force.
[Claim 2] While countering with the electrode of the above-mentioned fixed side electrode board, preparing two or more electrodes in the above-mentioned move lateral-electrode board and impressing voltage to the electrode of this move lateral-electrode board fixed Display according to claim 1 characterized by considering as the composition which rotates a move lateral-electrode board to a fixed side electrode board by the suction force which changes polarity to the electrode of the above-mentioned fixed side electrode, impresses voltage, and is produced in inter-electrode [of a move lateral-electrode board and a fixed side electrode board], and repulsive force.
[Claim 3] Display according to claim 1 characterized by considering as the composition which rotates a move lateral-electrode board to a fixed side electrode board by the suction force produced between the charge by which prepared the insulating layer which becomes the above-mentioned move lateral-electrode board from a dielectric, changed polarity to the electrode of the above-mentioned fixed side electrode, and impressed voltage, and induction was carried out to the move lateral-electrode board, and the electrode of a fixed side electrode board, and repulsive force.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention attains improvement and thin-shape-izing of an indicator of position control precision by making an electrostatic actuator into the driving source of an indicator in detail about the display used for meter, clocks, etc., such as a tachometer.
[0002]
[Description of the Prior Art] The display which displays physical quantity visually is offered by conventionally moving an indicator etc. according to the electrical signal which changed physical quantity. This display is used for the meter [, such as a tachometer of an automobile,] (rotational frequency of engine is displayed.), and indicator-type clock (time is displayed.) etc.
[0003] Since an indicator runs by this kind of display smoothly

and it is required that the position control precision of an indicator should be high, there is much what was made into the structure of driving an indicator by motors, such as a stepping motor. Moreover, as for this kind of display, it is desirable that it is a thin shape. Especially, in the case of the display for mount of a tachometer etc., when carried in vehicles, in order to secure the space in which other parts are attached, to be a thin shape as much as possible is demanded.

[0004]

[Problem(s) to be Solved by the Invention] Although it is necessary to connect the axis of rotation and an indicator to the axis of rotation of a motor through transfer mechanisms, such as a gearing, without fixing an indicator directly in order to attain thin shape-ization when making a motor into the driving source of an indicator as mentioned above, in this case, hysteresses, such as backlash, arise in a transfer mechanism, or problems, like equipment becomes complicated are in it. Therefore, when motors, such as a stepping motor, are made into a driving source, it is the limitation which is set to about about 30mm, and the thickness of display is difficult for attaining thin width-of-face-ization beyond it. Especially, in the case of the display for the above-mentioned mount, restrictions arise that thickness is about 30mm in the size of other parts, or the flexibility of arrangement.

[0005] It is made in order that this invention may solve the problem in the above conventional display, and the position control precision of an indicator is made for the purpose of offering thin display highly.

[0006]

[Means for Solving the Problem] Therefore, the hand spindle supported free [rotation] while the claim 1 inserted the end in the plotting board, The indicator fixed to the end of the above-mentioned hand spindle, and the move lateral-electrode board fixed to the other end of the above-mentioned hand spindle, It has the fixed side electrode board which has arranged two or more electrodes which countered this move lateral-electrode board and were fixed to the above-mentioned plotting board side. Polarity is changed to the electrode of this fixed side electrode board, voltage is impressed, and display equipped with the electrostatic actuator which carries out the rotation drive of the move lateral-electrode board towards desired to a fixed side electrode board by the suction force produced between charges and repulsive force is offered.

[0007] While a claim 2 counters with the electrode of the above-mentioned fixed side electrode board in a claim 1, preparing two or more electrodes in the above-mentioned move

lateral-electrode board and impressing voltage to the electrode of this move lateral-electrode board fixed Polarity is changed to the electrode of the above-mentioned fixed side electrode, voltage is impressed, and the display characterized by considering as the composition which rotates a move lateral-electrode board to a fixed side electrode board by the suction force produced in inter-electrode [of a move lateral-electrode board and a fixed side electrode board] and repulsive force is offered.

[0008] A claim 3 prepares the insulating layer which becomes the above-mentioned move lateral-electrode board from a dielectric in a claim 1, changes polarity to the electrode of the above-mentioned fixed side electrode, impresses voltage, and offers the display characterized by to consider as the composition which rotates a move lateral-electrode board to a fixed side electrode board by the suction force produced between the charge by which induction was carried out to the move lateral-electrode board, and the electrode of a fixed side electrode board, and repulsive force.

[0009]

[Function] Since it is considering as the composition which carries out the rotation drive of the hand spindle supported free rotation] by the electrostatic actuator while fixing an indicator to an end, the position of an indicator is precisely controllable by the display of a claim 1. Moreover, in a claim 1, since an electrostatic actuator is composition which fixes a move lateral-electrode board to a hand spindle, counters a movement side stationary plate and fixes a fixed side electrode board to a plotting board side, display is a thin shape.

[0010] In the display of a claim 2, an electrode is prepared in both a fixed side electrode board and a move lateral-electrode board, and by the suction force produced in inter-electrode [this], and repulsive force, since it is considering as the composition which rotates a move lateral-electrode board to a fixed side electrode board, a move lateral-electrode board moves for every one piece of an electrode to a fixed side electrode board.

[0011] Since it is considering as the composition which rotates a move lateral-electrode board to a fixed side electrode board by the suction force produced between the charge by which did not prepare an electrode in a move lateral-electrode board, but induction was carried out to the move lateral-electrode board in the display of a claim 3, and the electrode of a fixed side electrode board, and repulsive force, the structure of a move lateral electrode is easy.

[0012]

[Example] Next, based on the example shown in a drawing, this

invention is explained in detail. Drawing 1 and drawing 2 show the display concerning the 1st example of this invention. The display of this 1st example is a tachometer for automobiles. One in drawing is the case of the shape of a short cylinder which set the upper part to opening 1a. Pivot 1c which is tapering off towards a nose of cam is protruded on a part for the center section of pars-basilaris-ossis-occipitalis 1b of this case 1. On the other hand, opening 1b of the above-mentioned case 1 is closed by the disc-like plotting board 2. the circular hole penetrated in the direction of board thickness in the center section of this plotting board 2 -- 2a is prepared The above-mentioned pivot 1c is loosely inserted in this hole 2a, and a part for the point of the above-mentioned pivot 1c is projected on the plotting board 2 from the interior of a case 1.

[0013] The hand spindle shown by three in drawing is equipped with tapered bore 3a whose diameter is reduced towards a upper-limit side from the soffit side in drawing, and is attaching this tapered bore 3a outside the above-mentioned pivot 1c. The size of this tapered bore 3a is set up so that a crevice may be generated between the above-mentioned pivot 1c and the peripheral surface of tapered bore 3a. Moreover, the lubricating oil is poured into this crevice and the hand spindle 3 is supported by pivot 1c free [rotation].

[0014] Disc-like jaw 3b whose diameter was expanded outward [direction of path] is prepared in the soffit section of the hand spindle 3 located in the interior of the case 1 closed by the above-mentioned plotting board 2. the circular hole penetrated in the direction of board thickness on the 3d of upper surfaces of this jaw 3b at a part for a center section -- the drive board 4 which consists of a disk which prepared 4a is fixed

[0015] The indicator 6 is fixed to the upper-limit section of the hand spindle 3 which projects in the exterior of a case 1 from the above-mentioned plotting board 2. This indicator 6 equips other end 6c of directions section 6b end 6a instructs the position on the plotting board 2 to be, and this directions section 6b with 6d of bases established in one. Circular hole 6e is prepared in 6d of this base, and the indicator 6 is fixed to a hand spindle 3 by attaching this hole 6e outside the upper limit of the above-mentioned hand spindle 3. Thus, in the 1st example, the indicator 6, the hand spindle 3, and the drive board 4 are fixed to one, and if the drive board 4 rotates, a hand spindle 3 and an indicator 6 will also rotate.

[0016] In the upper surface of directions section 6b of the above-mentioned indicator 6, the emitter 7 which consists of a Light Emitting Diode is arranged. This emitter 7 is connected to the terminals 10a and 10b of a current carrying part 9 later

mentioned through the terminals 8a and 8b prepared in the 6d of the above-mentioned bases.
[0017] As shown in drawing 3 in detail, the current carrying part 9 which consists of a flexible substrate is provided in the periphery of a hand spindle 3. This current carrying part 9 was equipped with the copper foil 11 which connects Terminals 10a-10h and these terminals 10a-10h, and forms a necessary circuit, and has covered the whole portion other than terminal 10a-10h with the insulator layer 12. This current carrying part 9 is equipped with two circuits for supplying electric power to the emitter 7 prepared in directions section 6b of the above-mentioned indicator 6. these two circuits are later mentioned with the terminals 8a and 8b prepared in the above-mentioned indicator 6, and the terminals 10a and 10b to connect -- flexible -- it has the terminals 10c and 10d connected a conductor 13 side Moreover, the current carrying part 9 is equipped with two circuits for supplying electric power to the electrodes 25a and 25b of the A phase of the move lateral-electrode board 21 mentioned later, and a B phase. these two circuits are as flexible as the terminals 10e and 10f connected the move lateral-electrode board 21 side -- it has the terminals 10g and 10h connected a conductor 13 side In addition, it is not necessary to necessarily form this current carrying part 9 by the flexible substrate, and as long as it is ****, you may form it with the usual electric wire.
[0018] moreover, flexible on the periphery of the above-mentioned hand spindle 3 -- the conductor 13 is wound this -- flexible -- on sheet metal 13a made of a resin, copper foil 14 was fixed and the conductor 13 came so that it might be well-known, and it is equipped with 2 circuits for supplying electric power to the emitter 7 of the above-mentioned indicator 6, and two circuits for supplying electric power to the electrodes 25a and 25b of the move lateral-electrode board 21 mentioned later Each circuit equips the other end with the terminals 15e, 15f, 15g, and 15h linked to lead wire 16 while equipping an end with the terminals 15a, 15b, 15c, and 15d linked to the terminals 10c, 10d, 10g, and 10h of the above-mentioned current carrying part 9. This lead wire 16 is arranged to slot 2c prepared in inferior-surface-of-tongue 2b of the plotting board 2, and is connected to the relay 47 mentioned later.
[0019] The upper surface of the above-mentioned plotting board 2 indicates a necessary number etc., and forms 2d of dial faces. The emitter 17 which consists of the Light Emitting Diode same in a necessary part as directions section 6b of the above-mentioned indicator 6 is attached in the portion of 2d of this dial face. This emitter 17 is connected to the relay 47 later

mentioned through the lead wire 18 which ****(ed) in the plotting board 2.
[0020] The display of this example is considering the above-mentioned drive board 4 as the composition which drives by the electrostatic actuator 20 roughly shown in drawing 4 . This electrostatic actuator 20 is equipped with the move lateral-electrode board 21 stuck and fixed to upper surface 4b of the above-mentioned drive board 4, and the fixed side electrode board 22 stuck and fixed to inferior-surface-of-tongue 2b of the above-mentioned plotting board 2 so that it might counter with this move lateral-electrode board 21.
[0021] the above-mentioned move lateral-electrode board 21 is penetrated in the direction of board thickness in the center, as shown in drawing 5 -- circular -- a hole -- it is disc-like equipped with 21a], and field 23a by the side of the method of drawing 4 Nakashita of a substrate 23 is stuck on upper surface 4b of the above-mentioned drive board 4, and it is fixing Moreover, the insulating layer 24 which consists of a dielectric is formed in field 23b by the side of the upper part of the substrate 23 of the move lateral-electrode board 21, and they are the electrodes 25a and 25b of plurality [insulating layer / this / 24]... 25a and 25b are arranged.
[0022] The move lateral-electrode board 21 is equipped with the electrodes 25a and 25b of two groups which constitute an A phase and a B phase, respectively in this 1st example. electrode 25a which constitutes an A phase is long and slender -- being beltlike -- the inner circumference side of the above-mentioned move lateral-electrode board 21, i.e., the above, -- circular -- a hole -- it has prepared outward [direction of path] at intervals of the equal angle from the current collection section 26 annularly prepared in the circumference of 21a On the other hand, electrode 25b which constitutes a B phase is prepared in the sense in the direction of a path at intervals of the equal angle like the electrode of the above-mentioned A phase from the long and slender current collection section 27 which it was beltlike and was annularly prepared in the periphery side of the above-mentioned move lateral-electrode board 21. In the 1st example, if the angle interval of electrode 25b which constitutes a B phase is the same as the angle interval of electrode 25a which constitutes an A phase and this angle interval is set to theta, to electrode 25a of an A phase, clockwise, only 1/3theta would shift the phase to the clockwise rotation in drawing 5 , and it will arrange electrode 25b of a B phase. With the move lateral-electrode board 21 of the 1st example, since Electrodes 25a and 25b are arranged as mentioned above, as roughly shown in above-mentioned drawing 4 , the array pattern of

Electrodes 25a and 25b is "A phase, a B phase, and nothing."
[0023] The terminal 28 is formed in the current collection section 26 of the above-mentioned A phase. on the other hand -- the above from the current collection section 27 of the above-mentioned B phase -- circular -- the extending flow section 29 is formed to near the hole, and the terminal 30 is formed at the nose of cam of this flow section 29 The lead wire 31a and 31b arranged on the upper surface of the drive board 4 is connected to these terminals 29 and 30, and the terminals 32a and 32b of the other end of these lead wire 31a and 31b are connected to the terminals 10e and 10f of the above-mentioned current carrying part 9.
[0024] on the other hand, the above-mentioned fixed side electrode board 22 is penetrated in the direction of board thickness in the center like the above-mentioned move lateral-electrode board 21, as shown in drawing 6 in detail -- circular -- a hole -- it is disc-like [which prepared 22a], and field 33a by the side of the upper part of the substrate 33 in drawing 4 is stuck on inferior-surface-of-tongue 2b of the plotting board 2, and it is fixing moreover, the insulating layer 34 set to field 33b by the side of the lower part of the substrate 33 of the fixed side electrode board 22 from a derivative -- preparing -- the electrodes 35a, 35b, and 35c of plurality insulating layer / this / 34] ... 35a, 35b, and 35c ... 35a, 35b, and 35c are prepared these electrodes 35a, 35b, and 35c are all long and slender -- it is beltlike, and is arranged at intervals of an equal angle (angle theta) for every phase, and the three phase circuit of U phase, V phase, and W phase is formed
[0025] electrode 35a which constitutes U phase -- the inner circumference side of the above-mentioned fixed side electrode board 22, i.e., the above, -- circular -- a hole -- it has prepared outward [direction of path] at intervals of the angle described above from the current collection section 36 annularly prepared in the circumference of 22a Electrode 35b which constitutes V phase is prepared in the sense in the direction of a path from the current collection section 37 annularly prepared in the periphery side of the above-mentioned move lateral-electrode board 21, and shifts and arranges only 1/3theta for the phase to the clockwise rotation in drawing 6 to electrode 35a which constitutes the above-mentioned U phase. Electrode 35c which constitutes W phase is connected to the current collection section 39 which formed the fixed side electrode board 22 in upper surface 33a of a substrate 33 annularly through the flow section 38 penetrated in the direction of board thickness.
Moreover, electrode 35c which constitutes W phase shifts and arranges only 2/3theta for the phase to the clockwise rotation in

drawing 6 to electrode 35a which constitutes the above-mentioned U phase.

[0026] The flow section 41 which extends from the current collection section 36 of the above-mentioned U phase to the periphery side of the fixed side electrode board 22 was formed, and the terminal 42 is formed at the nose of cam of this flow section 41. Moreover, the terminal 43 is formed in the current collection section 37 of V phase. The flow section 44 which extends from the current collection section 39 of the above-mentioned W phase to the periphery side of the fixed side electrode board 22 was formed further again, and the terminal 45 is formed at the nose of cam of this flow section 44. The terminals 42, 43, and 45 of these U phase, V phase, and W phase are connected to a relay 47 through the lead wire 46 arranged to inferior-surface-of-tongue 2b of the plotting board 2. With the fixed side electrode board 22, since Electrodes 35a, 35b, and 35c are arranged as mentioned above, as roughly shown in drawing 4 , the array pattern of Electrodes 35a, 35b, and 35c serves as "U phase, V phase, and W phase."

[0027] In this 1st example, while impressing voltage fixed to the electrodes 25a and 25b of the A phase of the above-mentioned move lateral-electrode board 21, and a B phase, the electrodes 35a, 35b, and 35c of U phase of the above-mentioned fixed side electrode board 22, V phase, and W phase are received. Suction by static electricity which changes polarity, impresses voltage and is produced between the electrodes 25a and 25b of the move lateral-electrode board 21, and the electrodes 35a, 35b, and 35c of the fixed side electrode board 22, When the move lateral-electrode board 21 rotates to the fixed side electrode board 22 by repulsive force and the move lateral-electrode board 21 rotates, the drive board 4, a hand spindle 3, and an indicator 6 are united, and rotate.

[0028] A relay 47 is connected to the control means 52 (it illustrates only to drawing 1 .) which order it the drive of an indicator 6 according to this signal, and a power supply 53 while it changes into an electrical signal the rotational frequency of the engine which the sensor 51 (it illustrates only to drawing 1) detected. While this relay 47 changes polarity to the electrodes 35a, 35b, and 35c of the fixed side electrode board 22 of the above-mentioned electrostatic actuator 20 and impresses voltage according to the instructions from the above-mentioned control means 52, it impresses voltage fixed to the electrodes 25a and 25b of the move lateral-electrode board 21. Moreover, a relay 47 supplies electric power to the emitter 7 of the above-mentioned indicator 6, and the emitter 17 of the plotting board 2.

[0029] Next, the operation of the 1st example is explained. First, while impressing the voltage of "+" to electrode 25a of the A phase of the move lateral-electrode board 21 fixed as shown in drawing 7 in moving the move lateral-electrode board 21 in the clockwise direction as Arrow R shows, the voltage of "-" is impressed to electrode 25b of a B phase fixed.

[0030] On the other hand, polarity is changed to the fixed side electrode board 22 to the electrodes 35a, 35b, and 35c of U phase, V phase, and W phase, and voltage is impressed to it. In this 1st example, if one period is made into 360 degrees, only 240 degrees and 120 degrees of phases will be delayed for V phase and W phase to U phase, respectively, and voltage will be impressed by the same pattern.

[0031] First, let 0 degree - 120 degrees periods be U phase "+", V phase "-", and W phase "+." At this time, as shown in drawing 8 (A), repulsive force produces the move lateral-electrode board 21 and the fixed side electrode board 22 in the direction made to desert mutually between the electrodes 25a and 25b of the move lateral-electrode board 21, and the electrodes 35a and 35b of U phase of the fixed side electrode board 22, and V phase. Moreover, repulsive force and a suction force act and the move lateral-electrode board 21 moves in the direction of arrow R by one piece of electrode 35a so that the move lateral-electrode board 21 may be moved in the direction of Arrow R between the electrodes 25a and 25b of the move lateral-electrode board 21, and electrode 35c of W phase of the fixed side electrode board 22.

[0032] Next, let 120 degrees - 240 degrees periods be U phase "+", V phase "+", and W phase "-." At this time, as shown in drawing 8 (B), between the electrodes 25a and 25b of the move lateral-electrode board 21, and the electrodes 35b and 35c of V phase of the fixed side electrode board 22, and W phase, repulsive force acts in the direction which makes the move lateral-electrode board 21 desert, and between electrode 35a of U phase, repulsive force and a suction force act so that the move lateral-electrode board 21 may be moved in the direction of Arrow R. Therefore, the move lateral-electrode board 21 moves in the direction of arrow R by one piece of Electrodes 25a and 25b.

[0033] Furthermore, let 240 degrees - 360 degrees periods be U phase "-", V phase "+", and W phase "+." At this time, as shown in drawing 8 (C), repulsive force acts in the direction which makes the move lateral-electrode board 21 desert between the electrodes 25a and 25b of the move lateral-electrode board 21, and the electrodes 35a and 35c of U phase of the fixed side electrode board 22, and W phase, and

repulsive force and a suction force act so that the move lateral-electrode board 21 may be moved in the direction of Arrow R between electrode 35b of V phase. Therefore, the move lateral-electrode board 21 moves in the direction of arrow R by one piece of Electrodes 25a and 25b.

[0034] The move lateral-electrode board 21 rotates in the direction of arrow R for every one piece of Electrodes 25a and 25b by switching the voltage impressed to the electrodes 35a, 35b, and 35c of the fixed side electrode board 22 as mentioned above.

[0035] While setting polarity of the electrodes 25a and 25b of the A phase of the move lateral-electrode board 21, and a B phase to "0" as shown in drawing 7 in stopping movement of the move lateral-electrode board 21, polarity of the electrodes 35a, 35b, and 35c of U phase of the fixed side electrode board 22, V phase, and W phase is set to "0."

[0036] On the other hand, while impressing the voltage of "-" to electrode 25a of the A phase of the move lateral-electrode board 21 in rotating the move lateral-electrode board 21 in the counterclockwise direction in drawing as Arrow L shows, the voltage of "+" is impressed to electrode 25b of a B phase. Moreover, voltage is impressed by the pattern contrary to the case where the move lateral-electrode board 21 is rotated in the above-mentioned arrow R direction in this case to the electrode of U phase of the fixed side electrode board 22, V phase, and W phase. That is, in a 0 degree - 120 degrees period, U phase "+", V phase "-", W phase "+", and a 120 degrees - 240 degrees period make U phase "-", V phase "+", W phase "+", and a 240 degrees - 360 degrees period U phase "+", V phase "+", and W phase "-." Thus, by impressing voltage, the move lateral-electrode board 21 rotates in the direction of arrow L for every one piece of Electrodes 25a and 25b.

[0037] Thus, in the 1st example, if the move lateral-electrode board 21 can be rotated to the fixed side electrode board 22 for every one piece of Electrodes 25a and 25b and the move lateral-electrode board 21 rotates by changing the voltage impressed to the electrodes 35a, 35b, and 35c of the fixed side electrode board 22, the indicator 6 made into the move lateral-electrode board 21 and one through the drive board 4 and the hand spindle 3 will also move. Therefore, while being able to move an indicator 6 smoothly, the position of an indicator 6 is precisely controllable by the 1st example.

[0038] Moreover, in the 1st example, since the driving source of an indicator 6 is made into the electrostatic actuator as mentioned above, thin shape-ization of equipment can be attained as compared with the case where could set thickness of

equipment to about 5-6mm, and a stepping motor etc. is made into a driving source like the conventional display.

[0039] Next, the 2nd example of this invention is explained. In this 2nd example, as shown in drawing 9 and drawing 10 , the structure of the move lateral-electrode board 21 differs from the 1st example. That is, in this 2nd example, in the move lateral-electrode board 21, only 1/3theta could shift the phase and has prepared electrode 25c of C phase in electrode 25b of a B phase, and the clockwise rotation. The electrode of this C phase is connected to the current collection section 56 prepared in the inferior-surface-of-tongue annular which minded the flow section 55 which penetrates the move lateral-electrode board 21 in the direction of board thickness like V phase of the fixed side electrode board 22. Thus, in the 2nd example, the move lateral-electrode board arranges "the A phase, the B phase, and C phase" in order. Moreover, as shown in drawing 9 , electrode 25b of a B phase and electrode 25c of C phase are connected among Electrodes 25a, 25b, and 25c, and it is considering as BC phase. The composition of others of the 2nd example is the same as that of the 1st above-mentioned example.

[0040] Moreover, in moving an indicator 6 in the 2nd example, as shown in drawing 11 , it impresses voltage like the 1st example. First, in moving the move lateral-electrode board 21 in the direction of arrow R, it impresses the voltage of "-" to electrode 25a of the A phase of the move lateral-electrode board 21 fixed at "+" and electrode 25b of BC phase.

Moreover, the electrodes 35a, 35b, and 35c of the fixed side electrode board 22 are received. a 0 degree - 120 degrees period -- U phase "+", V phase "-", and W phase "+" (refer to drawing 12 (A) --) a 120 degrees - 240 degrees period -- U phase "+", V phase "+", and W phase "-" (refer to drawing 12 (B) --) a 240 degrees - 360 degrees period -- U phase "-", V phase "+", and W phase "+" (refer to drawing 12 (C) --) It carries out. Thus, by impressing voltage, the move lateral-electrode board 21 rotates in the direction of arrow R for every one piece of Electrodes 25a, 25b, and 25c.

[0041] Moreover, in moving the move lateral-electrode board 21 in the direction of arrow L, it impresses "-" to the A phase of the move lateral-electrode board 21, and impresses the electrode of "+" to BC phase fixed. Moreover, the electrodes 35a, 35b, and 35c of the fixed side electrode board 22 are received. In a 0 degree - 120 degrees period, U phase "+", V phase "-", W phase "+", and a 120 degrees - 240 degrees period make U phase "-", V phase "+", W phase "+", and a 240 degrees - 360 degrees period U phase "+", V phase "+", and W phase "-." Thus, by impressing voltage, the move

lateral-electrode board 21 rotates in the direction of arrow L for every one piece of Electrodes 25a, 25b, and 25c.
[0042] Like [this 2nd example] the 1st example of the above, since the move lateral-electrode board 21 can be moved for every one piece of Electrodes 25a, 25b, and 25c by changing the voltage impressed to the electrodes 35a, 35b, and 35c of the fixed side electrode board 22, the position of an indicator 6 is precisely controllable. Moreover, in the 2nd example, since the driving source of an indicator is made into the electrostatic actuator 20 as mentioned above, thin shape-ization can be attained as the whole equipment.
[0043] Moreover, in the 2nd example, the electrodes 25a, 25b, and 25c of the three phase circuit of an A phase, a B phase, and C phase are formed in the move lateral-electrode board 21, and the fixed side electrode board 22 has also formed the electrodes 35a, 35b, and 35c of the three phase circuit of U phase, V phase, and W phase, and since the move lateral-electrode board 21 and the fixed side electrode board 22 are the almost same structures, they can attain common use-ization of parts
[0044] In addition, in the 2nd example, it is good also as structure which connected electrode 25c of the above-mentioned C phase to the current collection section 27 of electrode 25b of a B phase, and reduced the labor in the current collection section 56 in drawing 10 .
[0045] Next, the 3rd example of this invention is explained. In this 3rd example, as shown in drawing 13 , although the move lateral-electrode board 21 has formed the insulating layer 24 set to upper surface 23a of a substrate 23 from a dielectric, it does not prepare an electrode in this insulating layer 24, but is considering it as the composition which carries out induction of the charge to an insulating layer 24 by the electrodes 35a, 35b, and 35c of the fixed side electrode board 22. The composition of others of the 3rd example is the same as that of the 1st above-mentioned example.

[0046] If the period of the voltage impressed to the electrodes 35a, 35b, and 35c of the fixed side electrode board 22 is made into 360 degrees in this 3rd example as shown in drawing 14 Among 0 degree - 120 degrees (the 1st step), 120 degrees - 240 degrees (the 2nd step), and 240 degrees - 360 degrees (the 3rd step), between the first durations alpha In order to carry out induction of the charge to the move lateral-electrode board 21, voltage is impressed to Electrodes 35a, 35b, and 35c, and since only the remaining predetermined time beta drives the move lateral-electrode board 21, voltage is impressed.
[0047] first, in rotating the move lateral-electrode board 21 in

the direction of arrow R As "-" and electrode 35c of W phase are set to "0" for "+" and electrode 35b of V phase and electrode 35a of the predetermined time alpha of the 0 degree - 120 degrees (the 1st step) beginning and U phase is shown in drawing 15 (A), induction of the charge is carried out to the insulating layer 24 of the move lateral-electrode board 21 in the array of "-", "+", and "0." Next, in the remaining predetermined time beta of the 1st step, as shown in drawing 15 (B), "+" and electrode 35c of W phase are made [electrode 35a of U phase] into "-" for "+" and electrode 35b of V phase. At this time, as shown in drawing 15 (B), suction and the repulsive force which are produced between the charges by which induction was carried out to the electrodes 35a, 35b, and 35c of the fixed side electrode board 22 and the move lateral-electrode board 21 arise, and as shown in drawing 15 (C), the move lateral-electrode board 21 moves in the direction of Arrow R by one piece of Electrodes 35a, 35b, and 35c.

[0048] next, at 120 degrees - 240 degrees (the 2nd step) Only the first predetermined time alpha electrode 35b of "0" and V phase for electrode 35a of U phase "+", Electrode 35c of W phase is made into "-", and induction of the charge is carried out to the move lateral-electrode board 21 in the array of "0", "-", and "+". in the remaining predetermined time beta The move lateral-electrode board 21 is moved in the direction of Arrow R by one piece of Electrodes 35a, 35b, and 35c, using [electrode 35a of U phase] "+" and electrode 35c of W phase as "+" for "-" and electrode 35b of V phase.

[0049] At 240 degrees - 360 degrees (the 3rd step), only the first predetermined time alpha electrode 35a of U phase "-", Electrode 35c of "0" and W phase is made into "+" for electrode 35b of V phase, and induction of the charge is carried out to the move lateral-electrode board 21 in the array of "+" "0" and "-". in the remaining predetermined time beta The move lateral-electrode board 21 is moved in the direction of Arrow R by one piece of Electrodes 35a, 35b, and 35c, using [electrode 35a of U phase] "-" and electrode 35c of W phase as "+" for "+" and electrode 35b of V phase.

[0050] In stopping the move lateral-electrode board 21, it sets altogether the electrodes 35a, 35b, and 35c of U phase of the fixed side electrode board 22, V phase, and W phase to "0."

[0051] In moving a move lateral electrode in the direction of arrow L, it impresses the polarity of the electrodes 35a, 35b, and 35c of the fixed side electrode board 22 by the pattern contrary to the case where the move lateral-electrode board 21 is moved in the above-mentioned arrow R direction. As shown in drawing 14 , namely, at 0 degree - 120 degrees (the 1st step)

Only the first predetermined time alpha makes [electrode 35a of U phase] "+" electrode 35C of "0" and W phase for "-" and electrode 35b of V phase, and makes [electrode 35a of U phase] "+" "-" and electrode 35c of W phase for "+" and electrode 35b of V phase in the remaining predetermined time beta. Next, at 120 degrees - 240 degrees (the 2nd step), only the first predetermined time alpha makes [electrode 35a of U phase] "-" "+" and electrode 35c of W phase for electrode 35b of "0" and V phase, and "+" and electrode 35c of W phase are made [electrode 35a of U phase] into "+" for "-" and electrode 35b of V phase in the remaining predetermined time beta. Furthermore, in a 240 degrees - 360 degrees period, only the first predetermined time alpha sets [electrode 35a of U phase] "-" and electrode 35c of W phase to "0" for "+" and electrode 35b of V phase, and "+" and electrode 35c of W phase are made [electrode 35a of U phase] into "-" for "+" and electrode 35b of V phase in the remaining predetermined time beta.

[0052] In this 3rd example, the move lateral-electrode board 21 can be moved for every one piece of Electrodes 35a, 35b, and 35c by changing the voltage impressed to the electrodes 35a, 35b, and 35c of the fixed side electrode board 22 as mentioned above. Although precision falls also to the move lateral-electrode board 21 a little as mentioned above as compared with the 1st example and the 2nd example which prepared the electrode, the position of an indicator 6 is controllable by comparatively high precision with the composition of this 3rd example. Moreover, in the 2nd example, since the driving source of an indicator is made into the electrostatic actuator, thin shape-ization can be attained as the whole equipment.

[0053] Moreover, in this 3rd example, as mentioned above, since it is considering as the composition which does not prepare an electrode, structure is easy for the move lateral-electrode board 21, and reduction of cost can be aimed at to it.

[0054] In addition, although this invention is not limited to the above-mentioned example, and various deformation is possible for it, for example, the display concerning the above-mentioned example is a tachometer for automobiles, this invention is applicable to the display of others, such as an indicator-type clock.

[0055]

[Effect of the Invention] Clearly from the above explanation, since the hand spindle supported free [rotation] is considered as the composition which carries out a rotation drive by the electrostatic actuator while fixing an indicator to an end, the position of an indicator is precisely controllable by the display of a claim 1. Moreover, in a claim 1, an electrostatic actuator fixes

a move lateral-electrode board to the above-mentioned ******, and since it is considering the fixed side electrode board as the composition which counters a movement side stationary plate and is fixed to a plotting board side, it can attain thin shape-ization of equipment as compared with the case where a stepping motor etc. is made into a driving source. For example, since thickness of equipment can be set to about 5-6mm when this display is used as the display for automobiles, a size and the flexibility of arrangement become large about other parts.

[0056] An electrode is prepared in both a fixed side electrode board and a move lateral-electrode board, since it is considering as the composition which rotates a move lateral-electrode board to a fixed side electrode board by the suction force produced in inter-electrode [this], and repulsive force, a move lateral-electrode board can be moved for every one piece of an electrode to a fixed side electrode board, and the position of an indicator can be controlled especially by display of a claim 2 with high degree of accuracy.

[0057] Especially in the display of a claim 3, an electrode is not prepared in a move lateral-electrode board, but by the suction force produced between the charge by which induction was carried out to the move lateral-electrode board, and the electrode of a fixed side electrode board, and repulsive force, since it is considering as the composition which rotates a move lateral-electrode board to a fixed side electrode board, the structure of a move lateral electrode is easy and reduction of cost can be aimed at as the whole equipment.